to biology, but the authors know this as well as we do; they have chosen their path and their book has a strong character of its own, which is more than can be said of many. We have previously referred to the "Teachers' Manual" by the same authors, and we see that there is another companion volume entitled "Applied Biology."

(3) We referred some time ago to Prof. E. Brucker's "Zoology" in the "Threshold of Science" series, and now we have his "Botany." Its conspicuous features are the simplicity of the style, the experimental introduction to the life of the plant, and the way in which the reader is led on from one cohort of natural orders to another. Referring plants to their natural orders is an educative discipline of sorts, but it seems to us to occupy far too large a part of this introductory book. There are many English introductions to the study of botany, and we do not see any reason why this translation should have been added to the list. A new introduction, to justify itself, should be in some way fresh and distinctive. The simplicity that we have alluded to does not always come off, as we may show by a couple of sentences:—"Once they have developed, even very dissimilar living things appear the more alike the younger the states at which they are compared," and "Algæ, mushrooms, bacteria and lichens form the four classes of the *type of algae.*" We protest against two of the lesson titles—"Beginnings of Philosophy" and "Philosophical Considerations Again." Needless to say, there is no philosophy in the lessons, nor should there be. The book is well illustrated.

(4) If a book of nature-study is to be used by junior pupils, which seems to us, in most cases, undesirable, Mr. Stenhouse's can be recommended as one of the best of its kind. It is simply and clearly written, and it is not much too informative. It prompts inquiry, not only in its questions and practical work, but also in its style; and this is a great virtue. The subjects dealt with are common British mammals, plants as food-makers, flowers and fruits and common trees, pond-life, burrowing animals, flying animals, the work of a river, and common stones and fossils. Mr. Stenhouse shows his good sense in keeping, on the whole, to common things and to phenomena which can be readily verified.

(5) Those who are never tired of criticising the modern efforts to lead school children into an intelligent and appreciative acquaintance with the world round about them should take account of a book like Mr. R. Lloyd Praeger's "Weeds," which appears to us very educative—in the truest sense—for the teacher. And happily it does not stand alone. Those teachers who wish to make themselves at home with some good subjects for nature study would do well to take a leaf from Mr. Lloyd Praeger's book. The root-idea is here, and the stem and its leaves and flowers are here too; for the author has shown that in the study of "weeds," which are always with us, you can get the brain-stretching discipline of precision, the mind-awakening appreciation of fitnesses, the naturalist's vision of inter-relations in the web of life, and more besides. The book is uncommonly well done, but it is for teachers—especially for teachers with a way with them. For children it is much too difficult; it is not in the right key. It might become a holy terror.

(6) Miss Kate M. Hall has written a useful and often skilful introduction to mammals, especially British mammals; but she should not have allowed her "good publisher" or herself to entitle the book externally—"Common British Animals." Mammals, to which the book is quite legitimately restricted, form a very small proportion of common British animals; so the title and title-page are quite misleading. Miss Hall knows how to teach, and we find on many a page an educative lesson; but too often this gift has been smothered in very interesting information. We think that a series of somewhat simpler studies on British mammals would have made a more effective book. But we recognise that part of the idea was to compare British with foreign forms.

CHEMISTRY OF PLANTS.

(1) *Untersuchungen über Chlorophyll. Methoden und Ergebnisse.* By Richard Willstätter and Arthur Stoll. Pp. viii+424+xi plates. (Berlin: Julius Springer, 1913.) Price 18 marks.

(2) *Biochemie der Pflanzen.* By Prof. Friedrich Czapek. Zweite umgearbeitete Auflage. Erster Band. Pp. xix+828. (Jena: Gustav Fischer, 1913.) Price 24 marks.

(1) THE paper cover in which the former of the above books is issued contains advertisements of the monographs by Emil Fischer on the amino-acids and proteins, on the purine substances, and on the carbohydrates, which are issued by the same publisher. The book of Willstätter and Stoll under review is a worthy successor of these classical works, and will be extremely welcome to all who have followed the publications during the last eight years of the researches of Willstätter and his pupils in Liebig's *Annalen*; they will be especially grateful for the full experimental details given in the description of the various preparations.

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The monograph is not merely a reprint of the numerous papers from Liebig's *Annalen,* but starts, in the first chapter, with a useful summary of all the results obtained up to the date of issue, and the relationship of the various substances isolated during the course of the researches is clearly indicated in tabular form. The book concludes with a description of some researches, most of which receive their first publication in this volume, on the pigments of the blood and their derivatives, and throw further light on the chemical relationship between the green pigment of plants and the red pigment of the blood, amplifying in a striking manner the earlier investigations of Hoppe-Seyler, Schunck, Nencki, and others.

It is difficult to select from such a mass of new material points for special mention in a short review. As an example, however, of the immense amount of patience and skill required in the preparation of chemically-pure preparations, the separation of chlorophyll into its components *a* and *b*, described on p. 163 *et seq.* may be cited; to obtain only a preliminary separation of the two substances contained in 8 grams of a mixture, no fewer than fourteen extractions of the solution in light petroleum with methyl alcohol were required, and 2 litres of the alcohol were employed for each extraction. Experimental details of this character are of interest, in that they illustrate the great technical difficulties of modern biochemical research, and the necessity of a somewhat costly equipment for laboratories devoted to this object; it is doubtful, indeed, whether the talent of a Willstätter would have availed in accomplishing what is described in this monograph, had there not been, in the first place, ample funds for the supply of the necessary material and apparatus, and in the second place, the cooperation of several accomplished students. The book contains many other examples of brilliant experimental technique, and for this reason alone it is well worthy of perusal by all chemists whose work entails large-scale laboratory operations.

Of the results of scientific interest, attention may, in the first place, be directed to the confirmation of the statement of Stokes, published in 1864, based on spectroscopic examination, that the chlorophyll of land-plants contains no fewer than four pigments. To this investigator and to Kraus and Sorby are due the principles of the method which, in the hands of Willstätter and his pupils, has finally led to the isolation of all the four pigments in a chemically-pure form.

Of great interest also, is the discovery of the fact that magnesium is an essential part of the chlorophyll molecule, just as iron forms an integral part of the molecule of the blood-pigment. No less interesting is the discovery of the alcohol, phytol, and of the enzyme phytase, an example of a new species of ferment capable of acting in alcoholic solutions. Mention must also be made of the mysterious change, designated by Willstätter "allomerisation," which takes place, apparently under the influence of some catalyst in alcoholic solution the exact nature of which has not yet been explained.

Although the results so far obtained do not warrant the assignment of a definite formula to the two chlorophylls, the general character of these pigments and of hæmin appears to be fairly well established. The recent valuable work of Piloty, Hans Fischer, and others on the synthesis of various pyrrole derivatives has also materially aided in the elucidation of the complex formulæ of these pigments. It is to be hoped that the publication of the researches on chlorophyll in their present form will afford a stimulus to research on plant physiology. The vexed question as to the mechanism of the sugar synthesis in the presence of chlorophyll still remains unsolved, and the fact that it is now possible to obtain the separate pigments of the leaf free from all contaminations should materially assist in the solution of this problem. Certain interesting suggestions as to the relationship of the pigments to one another, and as to their biological functions, are made in this monograph, which opens great vistas of future research.

(2) It is now nine years since the first edition of Prof. Czapek's two bulky volumes on the general chemistry of plants was issued, and it may be regarded as a favourable sign that a complete new edition of a work of this magnitude should be called for so soon. The first 240 pages of the present issue deal chiefly with general biological problems, including those relating to the physical structure of the cell, a subject which has received much attention from plant physiologists in recent times as a result largely of Prof. Czapek's own researches. The remainder of the volume is devoted to the special biochemistry of the sugars, fats, and lipoids, which are treated both from the more purely chemical and the physiological point of view. Books of reference of this description are indispensable nowadays to workers on biological chemistry, when the results of recent investigations are dispersed amongst so many journals. We owe, therefore, a great debt of gratitude to Prof. Czapek for his labours in collecting together a heterogeneous mass of material and issuing it in a form in which it can be readily reviewed.

S. B. S.

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